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Prevalence and Health Adverse Effects of Khat Chewing Among College Students in Jazan Region, Saudi Arabia

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ABSTRACT

Khat chewing is a social habit which has stimulatory action due to its cathinone content, but its adverse effects on health are a source of growing concern. The aim of our study is to evaluate the prevalence and health adverse effects of khat chewing among students in Jazan region in the Kingdom of Saudi Arabia (KSA). The study sample included 195 students from Applied Medical Science College, who were randomly selected and were asked through questionnaire and with a signed consent. About 5 ml of venous blood was collected in plain vacutainer tubes from 38 khat chewers and 20 non khat chewers as normal control. Serum was used to determine alanine aminotransferase (ALT), alkaline phosphatase (ALP), total and direct bilirubin, total protein, urea, creatinine, uric acid, and albumin. The sample consisted of 134 males and 61 females, with age range 19-27 years, and their mean age was 21.1 year. 40% of students were from urban area, and 81.5% of them from Jazan region. Out of 195 students, only 38 (19.5%) were found to chew khat. Biochemical results revealed highly significant differences among chewers in ALT, ALP, uric acid, and urea ($p<0.005$) compared to non-chewers group. There is also a significant difference in the total protein level (<0.05), while no significant differences were noticed in other biochemical traits analyzed. We concluded that the prevalence of khat chewing among students is fairly high (19.5 %), and that adverse effects of khat chewing on health are very clear, so all efforts should be contributed to solve this problem by increasing awareness of all members of the society to khat chewing risk.

Key words: *Khat chewing, prevalence, health adverse effects, college students*

Introduction

Khat plant (Catha edulis Forsk) containing amphetamine like compounds is cultivated particularly in the Eastern part of Africa and Arabic peninsula[1,2]. Khat is also known by different names such as Qat, Kat, Mirra, Quat, Abyssinian Tea, but in scientific studies it is commonly known by the name of Khat[3]. The origin of khat is unknown, however some botanists consider Ethiopia to be its native place[3]. It has been reported that Khat contains psychoactive and other chemicals i.e. nervous system stimulating chemicals[4–6]. It has been found that Khat chewers are at risk of developing of tachypnoea, hyperthermia, tachycardia, mydriasis, restlessness as well as relaxation[7], since new fresh sheets and new buds of khat contain high amount of amphetamine[8]. Khat chewing habit develops at an early age, it leads to an uncontrollable level and lasts throughout whole life[9].

It is projected that about 10 million people chew Khat worldwide, particularly most of the chewers are concentrated in the southwestern part of the Arabian Peninsula and East Africa, and immigrant communities living in Europe and North America[10,11]. Number of studies have reported that prolonged chewing may cause thrombocytosis leading to certain conditions including myocardial infarction[12], ischemic heart disease[13], distress sec-

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ondary to withdrawal and manic like schizophrenia[14–16]. Furthermore, its long-term use may cause several deleterious effects including erectile dysfunction[17], unsafe sex[18], psychotic experience[19,20], esophageal tumor [21], low birth weight and lactation problem[22], and anatomical as well as functional brain changes[22,23].

Additionally, Khat is also responsible for behavioral impairment in chewers that may be a cause of different criminal activities[10]. Current data from different parts of the world have revealed that Khat chewing is the most common malpractice among high school, college and university students and appears to be a critical problem as e.g. between 23.1% to 30.3% of chewers were reported in Saudi Arabia[24–26].

In another study, about 48.7% (45.7% in rural compared to 61.7% in urban areas) Khat chewers have been recorded in Jazan area. Additionally, other studies have revealed a high percentage of Khat chewers in many provinces, such as Sabiya (72.5%), Jazan (61.7%), Alhurath (58.1%), Abu Arish (56.8%) and Samtah (55.7%)[27].

Until now, several studies have been conducted among high school, college and tertiary students in Saudi Arabia. However, the main aim of this study was to investigate the pooled prevalence of Khat chewing and its adverse health effects among students in Saudi Arabia. Therefore, findings may be helpful in designing possible strategies that can be employed to resolve the problems in the KSA.

Subjects and Methods

This college based cross-sectional study was conducted in the Applied Medical Sciences College (Jazan University, KSA). A total of 195 students were enrolled in this study. A pre-tested self-administered questionnaire, which was prepared in Arabic, was used for data collection. The independent variables included different sociodemographic data and the main dependent variables were those of history of khat chewing. The questionnaire was distributed to all 195 students who were available during the data collection period. The distributed questionnaires were collected within ten days. The students were randomly selected, and were asked through self-administered questionnaire about their khat chewing habits, whether living in rural or urban region, duration of khat chewing, suffering from any health problems, history of khat chewing of their family members, influence of khat chewing on their studying, history of cigarette smoking, eventual influence of khat chewing on the positive characters, introduction to khat chewing habits and eventual benefits of khat chewing.

Laboratory tests

About 5 ml of venous blood was collected from 60 khat chewers and 20 non-chewers in plain vacutainer tubes. The separated serum was used to determine the following parameters using commercially available kits: alanine aminotransferase (ALT), alkaline phosphatase (ALP), total bilirubin, direct bilirubin, total protein, urea, creatinine, uric acid, and albumin (Human Diagnostics GmbH, Wiesbaden, Germany). These analyses were done as suggested by the manufacturer in Clinical Chemistry Laboratory of the Applied Medical Sciences College, Jazan University, KSA.

Statistical analysis

Categorical data were represented by absolute and relative frequencies. Numerical data were described by arithmetic means and standard deviations in case of normal distribution and by median and interquartile range in case of deviation from normal distribution. The variance of the category variables was tested by the Chi-square test. The differences between variables in two independent groups were tested by Student's t-test. Values at $p<0.05$ were considered to be statistically significant. The analysis was performed while SPSS 12.0 software (SPSS Inc., Chicago, IL).

Results

A total of 195 students from Applied Medical Science College participated in the study, 134 males and 61 females, aged 19-27 years, and their mean age was 21.1 year. The residence of 40% of the sample was urban, and 81.5% of them from Jazan region. Out of 195 students, 38 or 19.5 % chewed khat (Figure 1). About 19.4% of khat chewers started chewing khat at least 4 years ago. Only 8.7% of all students suffered from health problems but in case of khat chewers this percentage was 15.8%. In about 62.6% of all students, one or more members of their family chewed khat, while in 78.9% of khat chewers one or more members of their family chew khat. There is a significant correlation between participants' khat chewing and one family member chewing khat. 34 out of 134 male students (25.5%), and 6.6% (4 out of 61) of female students chewed khat (Figure 1). Regarding smoking, 11 out of 134 male students (8.2%), and 3 out of 61 female students (4.9%) smoked cigarettes (Figure 2). There is a highly significant correlation between chewing khat and smoking ($p<0.005$). Only 10 out of 78 urban students (12.8%), but

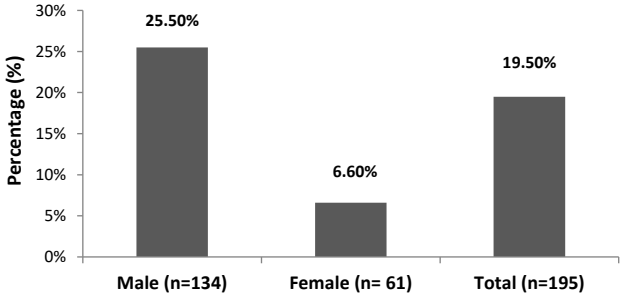

Fig. 1. Prevalence of khat chewing among students from College of Applied Medical Sciences in Jazan Region.

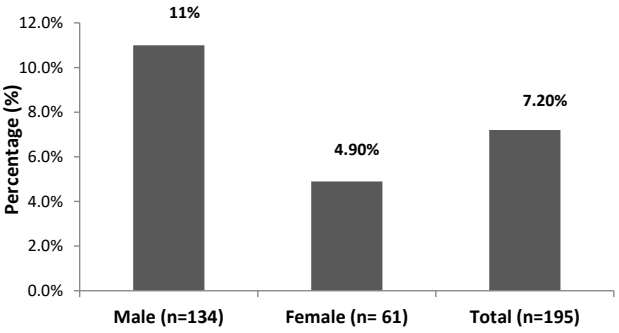

Fig. 2. Prevalence of cigarette smoking among students from College of Applied Medical Sciences in Jazan Region.

28 out of 117 rural students (23.9%) chewed khat. 5 out of 78 urban students (6.4%) and 9 out of 117 rural students (7.7%) smoked cigarette. Only 11 out of 195 (5.6%) thought that khat chewing gives them positive character, while among khat chewers, this percentage amounts to 15.8 % (6 out of 38). A highly significant correlation was found between chewing khat and thinking that chewing khat gives a positive character ($p<0.005$). About 83.6% of all students considered khat chewing had some disadvantages, while 12.8% of them thought that khat helped them in studying. On the other hand, 47.4% among khat chewers thought it helped them in studying. A highly significant correlation was also noticed between chewing khat and thinking that chewing khat helps in studying ($p<0.005$). Moreover, 26 out of 38 (68.4%) of khat chewers learned this habit from their friends, and 16 out of 38 (42.1 %) thought that khat chewing gave them some benefits while 38 out of 195 (19.5%) considered that khat chewing gave them some benefits. A statistically significant correlation was observed between chewing khat and thinking that chewing khat has a benefit ($p<0.005$).

Liver function tests (ALT, ALP, total bilirubin, direct bilirubin, albumin and total protein), Kidney function tests (creatinine, urea and uric acid) were performed for both chewing khat and non-chewing groups (Table 1). The results revealed highly significant differences between both groups in ALT, ALP, uric acid and urea ($p<0.005$). A statistically significant difference was also found in the total protein values ($p<0.05$). On the other hand, there were no significant differences in other biochemical traits tested (Table 2).

The Pearson correlation coefficients were calculated to find out potential correlations between biochemical results. The Pearson correlation results showed that there was a correlation between ALT, ALP, and urea ($p<0.01$), and between ALP and uric acid ($p<0.05$) as shown in Table 3.

TABLE 1

STATISTICAL ANALYSIS OF DIFFERENT BIOCHEMICAL TESTS FOR KHAT CHEWING AND NON-CHEWING GROUPS

Parameter/ Unit	Chewing Khat	Mean	S.D.	Std. Error Mean
Alanine amino transferase (ALT) U/L	Yes	34.43	14.75	1.91
	No	12.50	4.66	1.04
Alkaline phosphatase (ALP) U/L	Yes	74.42	11.91	1.54
	No	62.75	12.81	2.86
Albumin g/dl	Yes	3.77	0.36	0.05
	No	3.63	0.26	0.06
Total protein g/dl	Yes	6.47	1.29	0.17
	No	7.09	0.65	0.15
Direct bilirubin mg/dl	Yes	0.32	0.11	0.01
	No	0.31	0.10	0.02
Total bilirubin mg/dl	Yes	0.64	0.19	0.02
	No	0.64	0.18	0.04
Uric acid mg/dl	Yes	4.55	1.38	0.18
	No	3.18	0.64	0.14
Creatinine mg/dl	Yes	0.66	0.19	0.02
	No	0.58	0.16	0.04
Urea mg/dl	Yes	31.98	7.55	0.98
	No	21.20	4.57	1.02

Discussion and Conclusion

Our current study has found 19.5% khat chewers among the college students in Jazan region. Whereas earlier studies revealed that the frequency of khat chewers in Jazan region was about 48.7%[27] and 21.4%[24]. Our findings are in close agreement with the prevalence reported by Ageely et al.[24] because both studies were performed on college students, while that of Milaat et al.[27] was conducted in the general population. We should inform college students about the prevalence and harmful effects of khat chewing in order to minimize the use of khat[24]. Regarding incidence of chewing khat in other countries, a meta-analysis study showed pooled prevalence of khat chewing percentage among university students of 23.22% in Ethiopia (95% CI: 19.5, 27.0)[28], however, a higher percentage (80% for males, and 50% for females) of prevalence of khat chewing population was recorded in Yemen[29]. A possible explanation for these disproportionate findings might be due to the differences in the study area and settings with disparities in socio-cultural values and norms as well as religious beliefs as substantiated by other studies[30-32]. Another possible explanation might be ascribed to the differences in socio-economic status and research methodology. Similarly, our findings showed a much lower percentage (19.5%) than that reported by other studies performed in Eldoret, Kenya (68.9%)[33] and Nigeria[34]. Again, several factors may have been responsible for the variation including differences in culture, study design and policies of the respective universities, availability of substances, surrounding community, and the degree of knowledge of study participants about the health risks of khat chewing.

TABLE 2

THE INDEPENDENT SAMPLE T TEST OF KHAT CHEWING GROUP AND NON-CHEWING GROUP

	t-test for Equality of Means				
	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
				Lower	Upper
ALT	0.00	21.93	3.37	15.23	28.63
ALP	0.00	11.67	3.13	5.43	17.91
Albumin	0.12	0.14	0.09	0.04	0.31
Total protein	0.04	0.62	0.30	1.22	0.02
Direct bilirubin	0.67	0.01	0.03	0.04	0.07
Total bilirubin	0.92	0.01	0.05	0.10	0.09
Uric acid	0.00	1.37	0.32	0.73	2.01
Creatinine	0.09	0.08	0.05	0.01	0.18
Urea	0.00	10.78	1.79	7.21	14.35

TABLE 3

CORRELATIONS BETWEEN DIFFERENT BIOCHEMICAL PARAMETERS

	ALT	ALP	Albumin	T. protein	D. bilirubin	T. bilirubin	Uric acid	Creatinine	Urea
ALT		0.001	0.013	0.142	0.962	0.450	0.174	0.279	0.003
ALP	0.001		0.310	0.202	0.455	0.282	0.008	0.218	0.025
Albumin	0.013	0.310		0.632	0.908	0.764	0.942	0.820	0.032
T. protein	0.142	0.202	0.632		0.990	0.942	0.748	0.954	0.443
D. bilirubin	0.962	0.455	0.908	0.990		0.000	0.145	0.670	0.661
T. bilirubin	0.450	0.282	0.764	0.942	0.000		0.271	0.887	0.851
Uric acid	0.174	0.008	0.942	0.748	0.145	0.271		0.060	0.013
Creatinine	0.279	0.218	0.820	0.954	0.670	0.887	0.060		0.541
Urea	0.003	0.025	0.032	0.443	0.661	0.851	0.013	0.541	

In a recent stratified analysis, Ayano et al.[35], found that the pooled prevalence of current khat use was highest among university students in Saudi Arabia (18.85%) followed by Ethiopia (13.59%) and Yemen (13.04%). Sociocultural disparity may be responsible for this variation among the different countries. However, lifetime prevalence of khat consumption among university students was highest in Yemen (43.27%) followed by Ethiopia (24.82%) and Saudi Arabia (37.32%). Although, the studies suggest differences across various countries they are not statistically significant[35]. The findings of meta-analysis also demonstrated that gender was significantly associated with both current and lifetime Khat consumption among university students. Male students were 3.48 to 3.59 times more likely to be current and lifetime khat users than female students [35]. This high level of khat chewing in men might be due to the cultural norms of the countries. Furthermore, gender-related disparities in the brain might be another likely reason for difference[36].

Our current results revealed a highly significant correlation between liver function and khat chewing. These results are in agreement with Brostoff et al.[37] whose study is considered to be the first report on association between khat use and liver toxicity in human. In United Kingdom and the Netherlands three studies revealed that 19 patients had severe liver injury due to khat use[38-40]. In 2013, the first Australian report of khat associated hepatitis was done[41]. The exact mechanism of association of khat with liver injury remains unknown, although some animal studies suggest that there is a direct toxic effect from reactive khat metabolites or an immuno-allergic reaction on liver cells[41].

Khat chewing has negative effects on health and community, so all efforts should be contributed to solve this problem. These should be primarily aimed at increasing awareness of all members of the society of the khat chewing danger, introducing strict punishment to all persons who contribute to khat circulation, and organizing public awareness campaigns as well as providing support to social workers to resist khat chewing.

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PREVALENCIJA I ŠTETNI UČINCI NA ZDRAVLJE ŽVAKANJA KATA MEĐU STUDENTIMA U POKRAJINI JAZAN, SAUDIJSKA ARABIJA

S A Ž E T A K

Žvakanje biljke kat (Catha edulis) društveni je običaj u nekim afričkim i arapskim zemljama koji ima stimulativno djelovanje jer sadržava alkaloid katinon, iako sve više pobuđuje zabrinutost zbog štetnih učinaka na zdravlje. Cilj ove studije bio je ustanoviti prevalenciju i štetne učinke na zdravlje žvakanja kata među studentima medicinskog fakulteta u pokrajini Jazan u Saudijskoj Arabiji. Slučajno odabrani uzorak sastojao se od 195 studenata medicinskog fakulteta u Jazanu koji su ispitani pomoću upitnika uz informirani pristanak. Oko 5ml krvi izvađeno je u uzorku osoba koje uživaju kat i kontrolnom uzorku osoba koje ne žvaču kat.. Pomoću seruma određeni su u krvi alanin-aminotransferaza (ALT), alkalna fosfataza (ALP), ukupni i direktni bilirubin, ukupni protein, urea, kreatinin, mokraćna kiselina i albumin. Uzorak se sastojao od 134 muškarca i 61 žene u dobi od 19 do 27 godina čija je srednja dob bila 21,1 godina, a 40% studenata bilo je porijeklom iz grada, a 81,5% iz drugih mjesta u pokrajini Jazan. Utvrđeno je da je 38 (19,5%) studenata uživalo kat. Rezultati biokemijske analize pokazali su da postoje statistički značajne razlike između studenata koji žvaču kat i kontrolne skupine u parametrima ALT, ALP, mokraćnoj kiselini i urei ($p<0,005$). Značajna razlika utvrđena je također za ukupni protein ($p<0.05$), dok za druga biokemijska obilježja razlike nisu bile značajne. Studija ukazuje na jasne štetne učinke žvakanja kata na zdravlje te na potrebu ulaganja napora za podizanje svijesti svih članova društva o rizicima žvakanja kata.